

Remarks:

Claims 1-19 remain for consideration. Claims 1-17 were amended to recite the combination of a microelectronic substrate and a fill composition. Claims 18 and 19, depending from claim 1 (the only independent claim), were added to further define the type of the microelectronic substrate.

Turning now to the office action, the Examiner required that the Applicants update references to the parent applications in the first sentence of the specification. That portion of the specification now reflects the current status of all parent applications. The Examiner also objected to claim 1 as being in improper form for insufficient use of line indentations. This has been rectified with the amendment to claim 1.

In paragraph 5, the Examiner rejected claims 1-6 and 8-16 as being anticipated by, or obvious in view of, U.S. Patent No. 5,602,198 to Das et al., stating that Das et al. teach etch-resistant coating compositions comprised of an acrylic polymer binder, an aminoplast crosslinking agent, a solvent system, an organic pigment or dye, and a surfactant. As currently amended, independent claim 1 now recites the combination of a microelectronic substrate and a fill composition. Das et al. do not teach the use of their inventive composition in combination with a microelectronic substrate. Rather, Das et al. are concerned with coatings for automotive exteriors. Thus, claim 1 is novel over Das et al.

The Examiner further asserted that the Das et al. composition would possess the claimed properties of the invention; namely, that it would be at least about 70% removed during a prebake thermal stability test, and would show less than about 15% film shrinkage when subjected to a film

shrinkage test. To rebut the Examiner's assertion, the Applicants have enclosed a Declaration dated July 5, 2004, by Xie Shao, one of the inventors named on this application. As described in paragraph 3 of the Shao Declaration, an exemplary composition from the Das et al. patent was formulated according to that reference. The composition was subjected to the prebake thermal stability test and film shrinkage test as described in this application. The results set forth in the Shao Declaration demonstrate that the Das et al. composition clearly does not possess the claimed property of being at least about 70% removed during the prebake thermal stability test. In fact, it is hardly removed at all, being only 3.15% removed. Because the Das et al. composition does not possess the claimed prebake thermal stability property, this is a further reason that the teachings of this reference do not anticipate claim 1.

The Examiner stated that, in the alternative, the claimed invention would be obvious under Das et al. The Applicants respectfully submit that Das et al. should not be used to make an obviousness rejection because it is non-analogous art. First, the two inventions relate to distinctly different fields of endeavor. Das et al. concerns the field of endeavor of motor vehicle coatings, while the Applicants' field of endeavor is integrated circuit manufacture. One skilled in the art of integrated circuit manufacture would not have any incentive or motivation to look to the field of automobile paints.

Second, Das et al. is not relevant to the particular problem that the claimed invention solves. The claimed invention solves problems of poor or incomplete fill coverage and structure degradation on the sub-micron scale in dual damascene processes. The Das et al. composition provides a

durable, quick drying, and quick curing coating for automotive exteriors. Thus, the two inventions solve entirely different problems in their respective fields. Because the Das et al. reference is neither concerned with the same field of endeavor, nor solves the same problems as the current application, Das et al. is non-analogous art, and should not be used as a basis for an obviousness rejection.

Even if the Das et al. patent were analogous art, the claimed composition and the Das et al. composition have further differences that would make it highly unlikely that one of ordinary skill in the art would be motivated to alter the Das et al. teachings to achieve the Applicants' inventive combination. The Das et al. composition dries and cures rapidly at low temperatures. These properties would give little incentive for one skilled in the art to alter the Das et al. composition to create a reflowable bottom antireflective coating. The Das et al. composition is also noted for its superior acid etch resistance. As stated in this application, it is desirable for a fill composition to have an etch rate similar to the dielectric material used, and greater than that of the photoresist applied during the dual damascene process. This prevents etch polymer buildup, which helps preserve the integrity of submicron dual damascene structures. Again, one of ordinary skill in the art would not look to art that teaches compositions with high etch resistance to create a fill composition for dual damascene structures. Also, the Das et al. composition exhibits improved gloss. Highly reflective or glossy compositions would be highly undesirable for integrated circuit manufacture, as many fill compositions are designed to absorb light. The high gloss found in the Das et al. composition would cause light to be reflected back into the photoresist, leading to poor line patterns and increased device defects. With all these differences, there is simply no teaching,

suggestion, or motivation to modify the Das et al. composition to include the missing claim limitations. Therefore, claim 1 is patentable over Das et al.

The Examiner also rejected claims 1-3 and 5-15 as being anticipated by, or obvious under, U.S. Patent No. 5,859,136 to Scopazzi et al. The Applicants respectfully submit that this rejection has been overcome by amending claim 1 to recite the combination of a microelectronic substrate and a fill composition. Scopazzi et al. do not teach the use of their composition in conjunction with a microelectronic substrate. Scopazzi et al. teach only a composition for automotive refinish coatings. Claim 1 is, therefore, novel over Scopazzi et al.

The Examiner argued that, in the alternative, claims 1-3 and 5-15 would be obvious under Scopazzi et al. The Applicants respectfully submit that Scopazzi et al., like Das et al., should not form the basis of an obviousness rejection, because it is non-analogous art. Scopazzi et al. are concerned with automotive refinish coatings, and the Applicants are concerned with integrated circuit manufacture. One of ordinary skill in the art of integrated circuit manufacture would not look to automotive refinish coatings when developing fill compositions, as these are completely different fields of endeavor as discussed above with respect to Das et al. Additionally, the two inventions address distinctly different problems. The Scopazzi et al. reference provides a quick drying and quick curing composition with extended "pot life," while the Applicants have developed a composition that gives superior coverage and protection of dual damascene structures on a sub-micron scale. Because the claimed invention and the Scopazzi et al. composition neither solve the

same problem, nor address the same field of endeavor, the Scopazzi et al. reference is non-analogous art and should not be used to make an obviousness rejection.

Even if the Scopazzi et al. reference were analogous art, the Scopazzi et al. composition has additional properties that would give one skilled in the art no incentive to alter its teachings for use in integrated circuit manufacture. The Scopazzi et al. composition contains a gelled core, and dries and cures rapidly. In contrast, the fill composition of claim 1 is reflowable after the solvent has been removed, because the fill composition has not crosslinked to an appreciable degree. One skilled in the art would not look to the teachings of Scopazzi et al. when developing a fill composition with good reflowability and coverage of sub-micron dual damascene structures. The Scopazzi et al. composition forms films 0.5-5 mils. thick (column 9, lines 28-29), while fill compositions are designed to form much thinner films, about 35-250 nm thick, suitable for submicron-sized dual damascene structures (page 6, line 28). Again, one of ordinary skill in the art would not look to art that teaches thick automotive coatings when developing fill compositions for sub-micron features. Furthermore, the Scopazzi et al. composition displays improved gloss for use in automotive coatings, a highly undesirable quality in fill compositions, which are often designed to absorb light. A glossy composition would reflect light back into the photoresist, leading to increased incidence of device defects and poor line patterns. Because of all these differing properties, it cannot be said the Scopazzi et al. would teach, suggest, or motivate one skilled in the art to modify the Scopazzi et al. composition to include the missing claim limitations. Therefore, claim 1 is also nonobvious in view of Scopazzi et al.

In paragraph 7, the Examiner stated that claims 1-15 of the present application are anticipated by, or in the alternative obvious in view of, U.S. Patent No. 4,451,597 to Victorius. As stated previously, claim 1 now recites the combination of a microelectronic substrate and a fill composition. Claim 1 is not anticipated by Victorius, because Victorius teaches a coating composition for automobiles only, and not a coating in combination with a microelectronic substrate. Because of this, claim 1 is not anticipated by Victorius, and is novel over Victorius.

The Examiner further argued that the Victorius composition would display the properties in claim 1. To rebut the Examiner's argument, the Applicants have enclosed a Declaration dated August 10, 2001, by Xie Shao, an inventor named in this application. As described on page 6, the Applicants formulated a composition exactly according to Victorius, except the composition was prepared on a smaller scale. The resulting composition was subjected to the film shrinkage test as described in this application, using five different samples at three different bake temperatures. The results in Table E clearly show that none of the samples possessed the claimed limitation of less than about 15% film shrinkage, regardless of the bake temperature. This is a further reason that Victorius does not anticipate claim 1.

In the alternative, the Examiner argued that claim 1 would be obvious under the teachings of Victorius. As was the case with Das et al. and Scopazzi et al, the Applicants respectfully submit that Victorius is non-analogous art, and therefore should not form the basis of an obviousness rejection. The two inventions neither concern the same field of endeavor, nor solve similar problems. Victorius's field of endeavor is automotive coatings and paints, while the Applicants'

field of endeavor is integrated circuit manufacture. Additionally, the Applicants address prior art issues such as poor substrate coverage, reflow properties, and surface degradation, while Victorious provides a durable, quick curing, and quick drying automotive paint. Since the two references are neither in the same field of endeavor, nor do they solve similar problems, the Victorious reference is non-analogous art, and should not form the basis of an obviousness rejection of claim 1.

Even if the Victorious composition were analogous art, the two inventions differ so vastly that one of ordinary skill in the art would not be motivated to modify the Victorious composition to obtain the claimed composition. The Victorious composition is quick drying and quick curing at low or ambient temperatures. One skilled in the art of integrated circuit manufacture would have no incentive to change such a composition to create reflowable fill compositions with good coverage of sub-micron dual damascene structures. Additionally, the Victorious composition displays improved gloss, making it unsuitable for use as a fill composition. A glossy fill composition would cause light to be reflected back into the photoresist, leading to increased incidence of device defects and poor line patterns. Because of these differences, one of ordinary skill in the art would find no teaching, suggestion, or motivation to modify the Victorious composition to obtain the claimed composition. Therefore, claim 1 is patentable over Victorious.

In paragraph 8, the Examiner rejected claims 1-6 and 8-15 as being anticipated by U.S. Patent No. 4,727,100 to Vasta. Again, claim 1 as amended now recites the combination of the composition with a microelectronic substrate. Vasta teaches a composition suitable for coating "treated and untreated metal substrates, primed metal substrates, phosphatized steel substrates, primed

phosphatized steel substrates, plastic substrates, reinforced injection molded substrates, polyamide substrates and the like" (column 6, lines 30-35) in the context of automobile manufacture and finishing, not for use on the sub-micron scale in integrated circuit manufacture. Thus, claim 1 is novel over Vasta.

Claims 1-6 and 8-15 are also not obvious under Vasta for much of the same reasons discussed above with respect to the other cited references. That is, Vasta is non-analogous art, and the Applicants respectfully submit that it should not be used as the basis of an obviousness rejection. The two inventions concern completely different fields of endeavor; Vasta concerns automotive exterior coatings, while the present application concerns integrated circuit manufacture. One skilled in the art of integrated circuit manufacture would not think to look in the area of automotive coatings to solve the unique problems of integrated circuit manufacture. Additionally, the two inventions solve different problems. Vasta provides a quick drying, shiny, durable coating composition for automobiles, while the Applicants provide a combination of a microelectronic substrate and a fill composition that shows superior sub-micron device feature integrity and has properties desirable in integrated circuit manufacture. Therefore, Vasta should not be used in an obviousness rejection.

Even if the Vasta patent were analogous art, the Vasta patent teaches a composition with properties that would not teach, suggest, or otherwise motivate one of ordinary skill in the art to alter its teachings to arrive at the claimed invention. As mentioned previously, Vasta emphasizes the coating composition's ability to dry and cure quickly at low or ambient temperatures. One skilled in the art would not alter the Vasta reference to create a reflowable fill composition with good

coverage of sub-micron dual damascene structures. The Vasta composition also exhibits improved gloss. In a dual damascene process, a high-gloss automotive coating such as the Vasta composition would cause light to be reflected back into the photoresist, causing poor line patterns and device defects. The differences between the Applicants' invention and the Vasta composition show that there is simply no teaching, suggestion, or motivation for one skilled in the art to alter the Vasta composition to include the missing claim limitations. Because of this, claim 1 is non-obvious in view of Vasta.

The Examiner also rejected claims 1-3, 5, 6, and 8-16 as being anticipated by, or obvious in view of, U. S. Patent No. 4,981,891 to Felter et al., which teaches anti-static or static dissipative coatings. This rejection has been overcome by amending claim 1 to recite the combination of a microelectronic substrate and a fill composition. Felter et al. teach the use of their composition only as an antistatic or static dissipative coating. Furthermore, Felter et al. do not teach the use of their composition in conjunction with a microelectronic substrate. Thus, claim 1 is novel over Felter et al.

The Examiner stated that, in the alternative, claims 1-3, 5, 6, and 8-16 are obvious under Felter et al. The Applicants respectfully submit that Felter et al. is non-analogous art, and should not be used in an obviousness rejection. Felter et al. and the Applicants address two distinctly different fields of endeavor. The Applicants are concerned with creating coatings for integrated circuit manufacture, while Felter et al. are concerned with creating antistatic or static dissipative coatings. One having ordinary skill in the art would not look at a field so distant to integrated circuit

manufacture as aerosol antistatic coatings. The inventions solve different problems in their respective fields of endeavor. Felter et al. address problems with prior art antistatic coatings, such as hygroscopicity of antistatic compounds, and application by spraying or painting. The Applicants, as mentioned previously, are solving the problems of poor coverage and erosion of sub-micron dual damascene structures during integrated circuit manufacture. The Felter et al. patent is non-analogous art, and thus should not form the basis of an obviousness rejection.


Furthermore, the teachings of Felter et al. are such that one of ordinary skill in the art would not be motivated to alter the Felter et al. composition to obtain the claimed combination, even if it were analogous art. Felter et al. teach an antistatic coating suitable for aerosol application onto surfaces such as metals and plastics. Dual damascene fill compositions are applied by methods such as spin-coating onto silicon wafers, and must achieve a very thin, highly uniform film. One skilled in the art would not look to art teaching an aerosol composition to achieve a highly uniform sub-micron scale film necessary for a good fill composition. Additionally, the Felter et al. composition is ideally quick-drying at ambient conditions, which would generally teach one skilled in the art that the Felter composition would not possess suitable reflowability and fill properties for use in integrated circuit manufacture. Because nothing in the Felter et al. patent would motivate, teach, or suggest one skilled in the art to include the missing claim limitations, claim 1 is patentable over Felter et al.

In paragraph 10, the Examiner rejected claim 17 as being obvious in light of Das et al., or Felter et al., further in view of U.S. Patent No. 4,834,799 to Song. However, claim 17 depends from claim 1, and is patentable for the same reasons as discussed above.

In conclusion, independent claim 1 is novel over each of the cited references because none of those references teach or suggest the microelectronic substrate of the claimed combination. The Applicants have also demonstrated that Das et al. and Victorius do not teach compositions possessing both of the claimed composition properties. Furthermore, none of the cited references should be used to make obviousness rejections as they are concerned with different fields of endeavor and address different problems from the present invention. Thus, they are non-analogous art. Even if the Examiner took the position that these references were analogous art, the respective teachings of the references contain no motivation or suggestion to combine the particular reference's composition with a microelectronic substrate and, in fact, these references would actually teach away from this change.

It is believed that no further issues remain with this application. The Applicants respectfully request a Notice of Allowance. Any additional fee due in connection with this Amendment should be applied against our Deposit Account No. 19-0522.

Respectfully submitted,

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